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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/138,429 | 08/24/1998 | IMRAN HASHIM | AMAT/2406/MD | 4066 |

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APPLIED MATERIALS, INC.
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SANTA CLARA, CA 95050

EXAMINER

MERCADO, JULIAN A

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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1745

DATE MAILED: 08/27/2002

17

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/138,429

Applicant(s)

HASHIM ET AL.

Examiner

Julian A. Mercado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 10 October 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) _____ is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Remarks

This Office Action is responsive to Applicant's amendment filed October 10, 2001.

Claims 1-3, 5, 6, 15, 16 and 18-20 have been canceled per Applicant's amendment. New claims 21-31 are pending for consideration.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman (U.S. Pat. 5,380,414) in view of Ghanbari et al. (U.S. Pat. 5,455,197)

The rejection is maintained for the reasons of record and for the additional reasons to follow. Although new claims 21-31 are pending, the scope of the claims appears to be substantially similar in structure and scope as compared to claim 1 (for the apparatus claims) and claim 15 (for the method claims), with the exception that the new claims now recite that the magnet array is concentrically positioned *around an outer perimeter of the substrate surface* in place of the prior broader limitation of "about the substrate surface". [emphasis added]

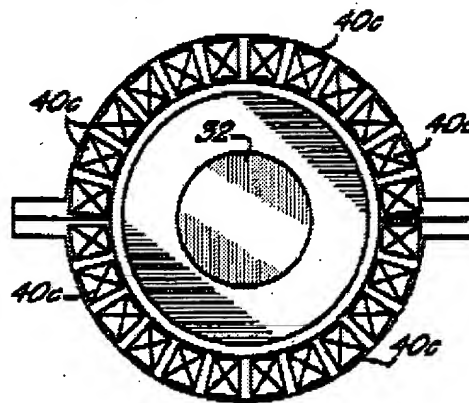
Tepman was discussed in detail in the previous Office Action, in which a sputtering chamber contains a target [2], a substrate [4] and a collimator [3] positioned therebetween. A magnet array [11] is disposed within the chamber to form a magnetic field at the surface of the

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substrate. The magnetic array is considered to be in an annular configuration such as shown in the magnetic array being in the form of hemispherical "U-shaped" closed loops with the opposing magnetrons [11] coming out of the plane of the page and forming a closed circular ring. The examiner made this conclusion with the assumption that Figure 2 which shows the magnetic array [11] is a sectional view.

While Tepman does not explicitly teach the magnet array concentrically positioned around an outer perimeter of the substrate surface, as discussed in the previous Office Action Ghanbari shows concentrically positioned magnetic arrays [40c] around a substrate [32]. The magnet arrays are positioned around an outer perimeter of the substrate surface. See column 4 line 62-65 and Figure 2.

Positioned in the proximity of the wafer 32, preferably surrounding the circular edge or periphery of the wafer 32, is a ring shaped auxiliary magnet 40, illustrated in FIG. 1 as including a solenoid electromagnet 40a. The magnet 40 is

**FIG. 2**

Thus, the skilled artisan would have found obvious to modify Tepman's invention by employing a concentrically positioned magnetic array around an outer perimeter of the substrate surface.

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The motivation for such a modification would be to enhance the flux of ions sputtered onto the wafer and optimize the crystal orientation of the sputtered film.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman in view of Ghanbari et al. as applied to claim 21 above, in view of Hsu (U.S. Pat. 5,589,039).

The rejection is maintained for the reasons of record. A reiteration here follows. While Tepman does not explicitly teach a target comprising a magnetic material which retains its magnetic properties upon deposition, Hsu specifically teaches that the domains of a magnetic sputtered target [21] are aligned during deposition with application of a substantially parallel magnetic field. (Col. 1 lines 43-52 and col. 5 lines 49-53) Thus, it would have been obvious to one of ordinary skill in the art that a target of magnetic material would retain its magnetic properties upon deposition because of the effects of the substantially parallel magnetic field thereon.

Claims 23, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman in view of Ghanbari et al. and Hsu as discussed for claim 2 above, and further in view of Boys et al. (U.S. Pat. 4,500,409).

The rejection is maintained for the reasons of record. A reiteration here follows. While Tepman does not explicitly teach a long throw distance of at least 50 mm (claims 23 and 26) Boys teaches a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37) Thus, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to further

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modify Tepman's invention by employing a long throw distance of at least 50 mm in order to enhance the deposition rate and uniformity.

While Tepman does not explicitly teach a a Ni/Fe alloy for the target (claim 25), Boys teaches a Ni/Fe alloy, which is known in the art as Permalloy. (Col. 12 line 23) Thus, it would have also been obvious to use Ni/Fe as the target material as this material is well-known and its use would have been motivated for reasons such as commercial availability and well-known performance for a magnetic film material.

Claims 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alex (U.S. Pat. 5,616,218) in view of Boys et al. and Ghanbari et al.

Alex has been discussed in detail in the previous Office Action, in which a grounded collimator [46] is positioned between a target [43] and a substrate [49]. (applies to claim 27 and 31)

While Alex does not explicitly teach sputtering at a pressure of less than about 15 mTorr or 5 mTorr (claims 27 ad 28, respectively) or a T/S distance of at least 50 mm (claim 29), Boys is relied upon to teach a pressure of less than about 5 mTorr or a T/S distance of at least about 50 mm. Thus, the skilled artisan would have found obvious to employ a pressure of less than 5 mTorr or 15 mTorr and employ a T/S distance of at least 50 mm, for reasons such as enhancing the sputtering efficiency and uniformity of the deposition process.

Alex does not explicitly teach a Ni/Fe target. (claim 30) However, Boys teaches a Ni/Fe target such as found in a Permalloy target. Thus, the skilled artisan would have found obvious to

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employ a Ni/Fe target for reasons such as employing a target which is commercially available and having a well-known performance as a magnetic film material.

As to generating a substantially parallel magnetic field using a concentrically positioned magnet array for in which the magnet array is positioned around an outer perimeter of the substrate surface, as discussed in the previous Office Action and further detailed above, Ghanbari is maintained to teach this configuration. Thus, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to further modify Alex's invention by providing a substantially parallel magnetic field at the surface of the substrate during sputtering. The motivation for such a modification would be to align the magnetic domains of the sputtered film by using a symmetrical magnetic field around a correspondingly shaped substrate.

Conclusion

The prior art relied upon in this Office Action will not be provided since it is the same prior art made of record in the previous Office Action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Pat. 5,643,422 to Yamada et al. is cited of cumulative interest.

This is a continuation of Applicant's earlier Application No. 09/138,429. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first

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action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julian A. Mercado whose telephone number is (703) 305-0511. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3599 for regular communications and (703) 305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


August 23, 2002


Patrick Ryan
Supervisory Patent Examiner
Room 1700